# "Perspectives on Seasonal Forecasting"

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➢ What are the key phenomena/processes driving climate predictability over the Mediterranean region? What are the relative contributions from local and remote sources of predictability?

➢ How can a better understanding of processes leading to predictability be exploited to generate advanced empirical forecast system as well as more suitable bias correction, combination and downscaling techniques?

➢ What is the maximum level of climate prediction skill that can be reached through optimized post-processing methodologies to extract useful information?

➤ What is the benefit that can be demonstrated for applications in relevant economical sectors in the Mediterranean?

**Perspectives on Seasonal Forecasting** 

**Three main streams of development:** 

Filling knowledge gaps

> Technological advancements

Improving information extraction and provision of user-oriented products

## A new Operational Seasonal Prediction System

**CMCC (CSP) is one of the centres contributing to the Copernicus Pre-Operational Seasonal Forecasting System** (along with ECMWF, MetOffice, MeteoFrance and DWD)

1. Improving the climate model (components and resolution)

- 2. Improving the initialization strategy
- 3. Increasing the size of the forecast ensembles

# A new Operational Seasonal Prediction System CMCC-SPSv3: <u>improving the climate model</u>



# A new Operational Seasonal Prediction System CMCC-SPSv3: increasing the forecast ensemble size

#### **Initial Condition Perturbations** → Ensemble Forecasts

• The initial condition (I.C.) for the forecasts will be created from a larger set of initial conditions obtained by combining different ocean, atmosphere and land states.

• <u>Perturbed ocean I.C.s will be created by generating eight (8) reanalyses</u> through perturbation of the ocean observations (in the analysis step), perturbation of atmospheric forcing and introduction of stochastic physics, in the forecast step.

• <u>Nine (9) backward lagged atmospheric I.C.s</u> will be prepared for the target date with a backward lag step of 12h.

• <u>Three (3) land state I.C.s</u> will be obtained from the land analyses performed with CLM forced with atmospheric fields from different analyses (ECMWF, NCEP, F(ECMWF, NCEP))

#### A set of 216 (= 8\*9\*3) initial states generated and 80 ICs randomly selected among this set

# A new Operational Seasonal Prediction System CMCC-SPSv3: increasing the forecast ensemble size



### Filling knowledge gaps

#### What are the key phenomena/processes driving climate predictability in the Mediterranean ?



## What are the relative contributions from local and remote sources of predictability?

#### Predictions of the El Niño indices: the NINO3.4 SST anomaly

How model systematic errors affect and limit predictions?



The ENSO signal is well predicted by state-of-the-art seasonal prediction systems, with anomaly correlation coefficients generally higher than 95%

### Information extraction and of user-oriented products

# **Improve information extraction**

develop advanced bias correction and forecast calibration methods;

 develop statistical/stochastic downscaling techniques to provide adequate climate prediction information for user-targeted products together with a measure of uncertainty at small scales;

• develop simple approaches for combining/weighting or selecting ensemble members/models to obtain more accurate and more reliable targeted impact forecasts.

# **Improve forecast verification**

• develop both deterministic and probabilistic multivariable user-driven forecast scores to allow for efficient and targeted forecast system comparison and evaluation of issues focused on Mediterranean applications.

# **Provision of user-oriented products**

• identification of specific indicators known to be relevant for important Mediterranean economical sectors.

# Thank you









